IN THE UNITED STATES DISTRICT COURT
FOR THE EASTERN DISTRICT OF TEXAS
MARSHALL DIVISION

XR COMMUNICATIONS, LLC, dba VIVATO TECHNOLOGIES, Plaintiff, v. AT&T SERVICES INC.; AT&T MOBILITY LLC; and AT&T CORP., Defendants.	Case No. 2:23-cv-00202-JRG-RSP **(Lead Case)** **JURY TRIAL DEMANDED**

DEFENDANTS / INTERVENOR'S NOTICE OF
PRIOR ART PURSUANT TO 35 U.S.C. § 282

Pursuant to 35 U.S.C. § 282, Defendants AT&T Corp., AT&T Mobility LLC, and AT&T Services, Inc. ("AT&T"), Verizon Communications, Inc. and Cellco Partnership d/b/a Verizon Wireless ("Verizon"), T-Mobile USA, Inc. ("T-Mobile"), and Intervenor Ericsson Inc. ("Ericsson") (collectively, "Defendants/Ericsson") hereby provide Plaintiff XR Communications, LLC dba Vivato Technologies ("XR") with notice of the prior art references and things upon which they may rely at trial to provide the invalidity of U.S. Patent Nos. 7,177,369, 8,737,511, and 10,715,235 (the "Asserted Patents") and/or the state of the art. Defendants/Ericsson also provide to XR a list of names and addresses of persons who may be relied upon as either a prior inventor, as having prior knowledge of the claimed inventions, and/or as having knowledge of prior use or offers for sale of the claimed invention.

Defendants/Ericsson reserve the right to amend, modify, or supplement this notice, consistent with the provisions of § 282.

In addition to the items identified below, Defendants/Ericsson incorporate by reference all prior art and information disclosed in their objections and responses to XR's interrogatories, the

Opening Expert Report of Dr. Kevin Negus, Defendants'/Ericsson's invalidity contentions and claim charts, as well as Defendants'/Ericsson's pleadings in this case.

I. Patents, Patent Publications, and Publications

TABLE 1: Prior Art Patents, Patent Applications, and Publications Anticipating and/or Rendering Obvious the Asserted Claims of the Asserted Patents

Number/Title	Country	Earliest Priority Date	Issue/Publication Date	Asserted Patents
6,359,923 ("Agee")	U.S.	December 18, 1997	March 19, 2002	'369 Patent '235 Patent
6,940,827 ("Li")	U.S.	March 9, 2001	September 6, 2005	'369 Patent
8,816,907 ("Beaudin")	U.S.	November 7, 2011	August 26, 2014	'511 Patent
2011/0150050 ("Trigui")	U.S.	December 23, 2009	June 23, 2011	'511 Patent
8,238,318 ("Negus")	U.S.	August 17, 2011	August 7, 2012	'511 Patent
7,224,758 ("Banister")	U.S.	February 16, 2002	May 29, 2007	'235 Patent
6,738,020 ("Lindskog")	U.S.	July 31, 2001	May 18, 2004	'235 Patent
6,888,809 ("Foschini")	U.S.	January 13, 2000	May 3, 2005	'235 Patent
2001/0031647 ("Scherzer")	U.S.	December 1, 1999	October 18, 2001	'235 Patent
6,124,824 ("Xu")	U.S.	January 29, 1999	September 26, 2000	'235 Patent
6,175,550 ("van Nee")	U.S.	April 1, 1997	January 16, 2001	'235 Patent
7,139,324 ("Ylitalo")	U.S.	June 2, 2000	November 21, 2006	'235 Patent
2003/0068983 ("Kim 983")	U.S.	May 25, 2001	April 10, 2003	'235 Patent

Number/Title	Country	Earliest Priority Date	Issue/Publication Date	Asserted Patents
2002/0190901 ("Yoshida 901")	U.S.	June 5, 2002	December 19, 2003	'235 Patent
2008/0170533 ("Cyzs")	U.S.	February 13, 2002	July 17, 2008	'235 Patent
WO2000001078A1 ("Harrison")	PCT	June 22, 1999	January 6, 2000	'235 Patent
2002/0060643 ("Levy 643")	U.S.	September 20, 2001	May 23, 2002	'235 Patent
WO2002047286A2 ("Hottinen 286")	PCT	December 6, 2000	June 13, 2002	'235 Patent
7,155,231 ("Burke")	U.S.	February 8, 2002	December 26, 2006	'235 Patent
5,933,421 ("Alamouti")	U.S.	February 6, 1997	August 3, 1999	'235 Patent
6,141,335 ("Kuwahara")	U.S.	December 4, 1997	October 31, 2000	'235 Patent
6,067,290 ("Paulraj 290")	U.S.	July 30, 1999	May 23, 2000	'235 Patent
5,828,658 ("Ottersten")	U.S.	October 23, 1996	October 27, 1998	'235 Patent
5,471,647 ("Gerlach 647")	U.S.	April 14, 1993	November 28, 1995	'235 Patent
2002/0018530 ("Kim 530")	U.S.	July 23, 2001	February 14, 2002	'235 Patent
6,947,707 ("Raghothaman")	U.S.	June 29, 2001	September 20, 2005	'235 Patent
6,553,012 ("Katz")	U.S.	February 13, 1997	April 22, 2003	'235 Patent
2003/0125040 ("Walton 040")	U.S.	November 6, 2001	July 3, 2003	'235 Patent

Number/Title	Country	Earliest Priority Date	Issue/Publication Date	Asserted Patents
7,248,841 ("Agee 841")	U.S.	June 13, 2000	July 24, 2007	'235 Patent '511 Patent
6,317,586 ("Haardt 586")	U.S.	January 28, 1999	November 13, 2001	'235 Patent
6,141,567 ("Youssefmir 567")	U.S.	June 7, 1999	October 31, 2000	'235 Patent
2004/0018818 ("Hottinen 818")	U.S.	December 6, 2000	January 29, 2004	'235 Patent
6,031,877 ("Saunders 877")	U.S.	December 16, 1996	February 29, 2000	'235 Patent
JP2002290317 ("Jitsukawa")	Japan	October 4, 2002	October 4, 2002	'235 Patent
2002/00131381 ("Kim 381")	U.S.	October 11, 2001	September 19, 2002	'235 Patent
7,116,723 ("Kim 723")	U.S.	July 23, 2001	October 3, 2006	'235 Patent
2002/0158801 ("Crilly")	U.S.	April 27, 2001	October 31, 2002	'235 Patent
5,634,199 ("Gerlach 199")	U.S.	April 17, 1995	May 27, 1997	'235 Patent '511 Patent
6,895,258 ("Scherzer 258")	U.S.	August 14, 2000	May 17, 2005	'235 Patent
6,760,388 ("Ketchum")	U.S.	December 7, 2001	July 6, 2004	'235 Patent
6,473,036 ("Proctor 036")	U.S.	February 2, 2001	October 29, 2002	'235 Patent
6,947,748 ("Li 748")	U.S.	December 15, 2000	September 20, 2005	'369 Patent
6,252,914 ("Yamamoto")	U.S.	July 20, 1999	June 26, 2001	'369 Patent
2009/0280866 ("Lo")	U.S.	November 14, 2006	November 12, 2009	'511 Patent

Number/Title	Country	Earliest Priority Date	Issue/Publication Date	Asserted Patents
2006/0166721 ("Sun")	U.S.	October 31, 2005	July 27, 2006	'511 Patent
2007/0280387 ("Li 387")	U.S.	May 24, 2007	December 6, 2007	'511 Patent
7,620,370 ("Barak")	U.S.	January 15, 2007	November 17, 2009	'511 Patent
9,252,908 ("Branlund")	U.S.	April 12, 2012	February 2, 2016	'511 Patent
2009/0322608 ("Adams")	U.S.	June 25, 2008	December 31, 2009	'511 Patent
2002/0132600 ("Rudrapatna")	U.S.	January 17, 2001	September 19, 2002	'511 Patent
8,442,449 ("Hui')	U.S.	November 8, 2010	May 14, 2013	``511 Patent
6,870,515 ("Kitchener")	U.S.	October 11, 2001	March 22, 2005	'511 Patent
8,134,504 ("U.S.")	U.S.	December 1, 2009	March 13, 2012	'511 Patent
2002/0132600 ("Rudrapatna 600")	U.S.	January 17, 2001	September 19, 2002	'511 Patent
2009/0322608 ("Adams")	U.S.	June 25, 2008	December 31, 2009	'511 Patent
2009/0010356 ("Engstrom")	U.S.	January 4, 2006	January 8, 2009	'511 Patent
6,611,231 ("Crilly 231")	U.S.	October 12, 2001	August 26, 2003	'511 Patent
8,204,151 ("Kim 151")	U.S.	January 8, 2009	June 19, 2012	'511 Patent
8,879,470 ("Zhang")	U.S.	February 27, 2009	November 4, 2014	'511 Patent

Number/Title	Country	Earliest Priority Date	Issue/Publication Date	Asserted Patents
8,385,305 ("Negus 305")	U.S.	April 16, 2012	February 26, 2013	'511 Patent
8,649,418 ("Negus 418")	U.S.	February 2, 2013	February 11, 2014	'511 Patent
8,989,762 ("Negus 762")	U.S.	December 5, 2013	March 24, 2015	'511 Patent
8,502,733 ("Negus 733")	U.S.	February 10, 2012	August 6, 2013	'511 Patent
8,422,540 ("Negus 540")	U.S.	September 10, 2012	April 16, 2013	'511 Patent
8,761,100 ("Negus 100")	U.S.	October 11, 2011	June 24, 2014	'511 Patent

TABLE 2: Non-Patent Prior Art Including Publications and Items Used, Known of, and/or Offered for Sale that Anticipate and/or Render Obvious the Asserted Claims of the Patents-in-Suit

Name	Author or Publisher	Publication Date	Asserted Patent
"Multiuser OFDM with Adaptive Subcarrier, Bit and Power Allocation," IEEE J. Select Areas Comm., Vol. 17(10), pp. 1747-1758 ("Wong")	Cheong Yui Wong, R.S. Cheng, K.B. Lataief, R.D. Murch	October 1999	'369 Patent
"An investigation into time-domain approach for OFDM channel estimation," IEEE Trans. Broadcasting, Vo. 46, no. 4. pp. 240-248 ("Minn")	H. Minn, V.K. Bhargava	December 2000	'369 Patent
"An Overview of Smart Antenna Technology For Mobile Communications Systems," IEEE Comm. Surveys, Q4 1999, Vol. 2, No. 4 ("Lehne")	Per Lehne	1999	'369 Patent '235 Patent '511 Patent

Name	Author or Publisher	Publication Date	Asserted Patent
3GPP TSG RAN WG1 R1-99c10 ("Motorola 3GPP")	Motorola	August 30-September 3, 1999	'235 Patent
Space-Time Signaling in Multi-Antenna Systems ("Heath 2001")	Robert W. Heath Jr.	November 2001	'235 Patent
"Joint Transmitter-Receiver Optimization in Synchronous Multiuser Communications over Multipath Channels," 46 IEEE Trans. Comm. 269 ("Jang")	Won Mee Jang, Branimir R. Vojcic, Raymond Pickholtz	February 1998	'235 Patent
"Transmit Diversity Using Filtered Feedback Weights in the FDD/WCDMA System," 2000 Int'l Zurich Seminar on Broadband Commc's Accessing Transmission Network Proceedings 15 ("Hottinen 2000")	Ari Hottinen, Risto Wichman	2000	'235 Patent
"Base Station Transmitter Antenna Arrays with Mobile to Base Feedback," 1993 Asilomar Conf. on Signals Systems and Computers 1432 ("Gerlach 1993")	Derek Gerlach, Arogyaswami Paulraj	1993	'235 Patent
"Transmit Diversity in 3G CDMA Systems," 40 IEEE Commc'ns Magazine 68, April 2002 ("Dewberry")	R. Thomas Dewberry, Steven D. Gray, D. Mihai Ionescu, Giridhar Mandyam, Balaji Raghothaman	April 2002	'235 Patent
"Opportunistic Beamforming Using Dumb Antennas," 48	Pramod Viswanath, David N. C.	June 2002	'235 Patent

Name	**Author or Publisher**	**Publication Date**	**Asserted Patent**
IEEE Trans. on Information Theory 1277 ("Viswanath")	Tse, Rajiv Laroia		
Feedback Assisted Multi-Antenna Transmission Weight Adaptation for Wireless Communications ("Banister 2002")	Brian Clarke Banister	2002	'235 Patent
"Channel Estimation Using Pilot Tones in OFDM System," IEEE Transactions on Broadcasting, Vol. 45, No. 4, (pp. 400-409) ("Yeh")	C.S. Yeh, Y. Lim	December 1999	'369 Patent
Digital Beamforming in Wireless Communications ("Litva")	John Litva, Titus Kwok Yeung Lo	August 31, 1996	'369 Patent '511 Patent '235 Patent
"Wireless Communications," Andreas F. Molisch, published November 23, 2010 (2nd edition), John Wiley & Sons, Ltd. (1st edition published January 1, 2005) ("Molisch")	Andreas Molisch	November 23, 2010	'511 Patent
3GPP TR 36.912 v. 9.3.0 (2010-06) 3rd Generation Partnership Project; Technical Specification Group Radio Access Network; Feasibility study for Further Advancements for EUTRA (LTE-Advanced) (Release 9)	3GPP	June 2010	'511 Patent
3GPP TR 36.912 v. 2.0.0 (2009-08) 3rd Generation Partnership Project; Technical Specification Group Radio Access Network; Feasibility study for Further Advancements for EUTRA (LTE-Advanced) (Release 9)	3GPP	August 2009	'511 Patent

Name	**Author or Publisher**	**Publication Date**	**Asserted Patent**
"WiMAX RF MxFE Transceiver, AD9352-5," Data Sheet, Analog Devices, 2008 ("AD9352-5")	Analog Devices	2008	'511 Patent
"WiMAX RF MxFE Transceiver, AD9353," Data Sheet, Analog Devices, 2007 ("AD9353")	Analog Devices	2007	'511 Patent
"WiMAX/WiBro RF MxFE MISO Transceiver, AD9355," Data Sheet, Analog Devices, 2008-2009 ("AD9355")	Analog Devices	2009	'511 Patent
"WiMAX/WiBro RF MxFE MISO Transceiver, AD9354," Data Sheet, Analog Devices, 2008-2009 ("AD9354")	Analog Devices	2009	'511 Patent
"WiMAX/BWA/WiBRO/LTE RF MxFE 2×2 MIMO Transceiver, AD9356," Data Sheet, Analog Devices, 2010 ("AD9356")	Analog Devices	2010	'511 Patent
"WiMAX/BWA/LTE RF MxFE 2×2 MIMO Transceiver, AD9357," Data Sheet, Analog Devices, 2010 ("AD9357")	Analog Devices	2010	'511 Patent
"WiMAX/WiBro RF MxFE Transceiver, AD9352," Data Sheet, Analog Devices, 2007 ("AD9352")	Analog Devices	2007	'511 Patent
"Dual Polarized Aperture Coupled Circular Patch Antenna Using a C-Shaped Coupling Slot," IEEE Transactions on Antennas and Propagation, vol. 51, No. 12, Dec. 2003, pp. 3295-3298 ("Padhi")	S.K. Padhi	December 2003	'511 Patent

Name	Author or Publisher	Publication Date	Asserted Patent
"DAN2400-PTP-Open SoC Platform for Sub-6GHz Wireless Point-to-Point Systems," DesignArt Networks, Jul. 2008, 2 pages ("DAN-2400")	Design Arts Networks	July 2008	'511 Patent

II. PERSONS HAVING KNOWLEDGE

Name	Address
Dr. Kevin Negus	Contact through outside counsel for Defendants/Ericsson
Dr. Tim Williams	Contact through outside counsel for XR
Dr. Todor Cooklev	Contact through outside counsel for XR

Also, the named inventors of each of the prior art patents and patent publications and the authors of the prior art publications are also persons having knowledge and/or are prior inventors.

III. BACKGROUND ITEMS AND/OR OTHER INFORMATION

In addition to the teachings and knowledge demonstrated in the above identified documents, Defendants/Ericsson provide notice of the following background items and/or other information to be relied upon in explaining the state of the art, the level of ordinary skill in the art, background of the technology at issue, terms or components in a reference above, motivation to combine, and the prosecution history of the Asserted Patents.

Background Items
Prior art listed in the file history of the Asserted Patents, or that of any related foreign or domestic patent applications
HOMERF
GSM
IS-95
WCDMA
CDMA2000

Background Items
IEEE 802.11-1999
IEEE 802.11a-1999
IEEE 802.11b-1999
IEEE 802.11f-2003
IEEE 802.11g-2003
IEEE 802.11h-2003
IEEE 1000: The Authoritative Dictionary of IEEE Standards Terms, Seventh Edition (IEEE 2000), p. 859 (definition of "pre-emphasis")
Smart Antennas for Dummies (Author: Arild Jacobsen, ISBN: 82-423-0388-6)
Gerard. J. Foschini (October 1996), "Layered Space-Time Architecture for Wireless Communication in a Fading Environment When Using Multi-Element Antennas," Bell Laboratories Technical Journal: 41–59.
P. W. Wolniansky; G. J. Foschini; G. D. Golden; R. A. Valenzuela (September 1998), "V-BLAST: An Architecture for Realizing Very High Data Rates Over the Rich-Scattering Wireless Channel," Proc. URSI ISSSE: 295–300.
U.S. 4,750,147
U.S. 4,965,732
U.S. 5,515,378
U.S. 5,546,090
US 5,642,353
U.S. 5,553,074
U.S. 5,697,066
U.S. 5,739,788
U.S. 5,886,988
U.S. 5,890,067
U.S. 6,006,110
U.S. 6,067,290
U.S. 6,101,399
U.S. 6,219,561
U.S. 6,330,460
U.S. 6,351,499
U.S. 6,564,036
U.S. 6,665,545
U.S. 6,687,492
U.S. 6,795,409
U.S. 7,130,662
U.S. 7,212,499
U.S. 6,301,238
U.S. 6,621,454
WO00/072464
WO01/010156
WO03/075396
WO97/00543

Background Items
WO97/33388
WO98/18271
"Adaptive Transmitting antenna arrays at the Base Station in Mobile Radio Networks," Derek Gerlach
A.S. Acampora, S.V. Krishnamurthy, and M. Zorzi, "Media Access Protocols for Use with Smart Adaptive Array Antennas to Enable Wireless Multimedia Communications" Wireless Networks, Springer-Verlag, 1998.
Z.-S. Zhang and A.S. Acampora, "Performance of a Modified Polling Strategy for Broadband Wireless Access in a Harsh Fading Environment," Telecommunication Systems, Vol. 1, No. 3, 1993.
A. Acampora and S Krishnamurthy, "A New Adaptive MAC Protocol for Broadband Packet Networks in Harsh Fading and Interference Environments", IEEE/ACM Transactions on Networking, Vol. 8, No. 3, June 2000.
S.V. Krishnamurthy, A.S. Acampora, and M. Zorzi, "Polling-Based Media Access Protocols for Use with Smart Adaptive Array Antennas," IEEE/ACM Trans. Networking Vol. 9, No. 2, April 2001.
Z. Zhang and A.S. Acampora, "Performance of a Modified Polling Strategy for Broadband Wireless LANs in a Harsh Fading Environment," IEEE GLobecom '91 Conference Record, Dec. 1991, Phoenix.
S. Krishnamurthy, A. S. Acampora, and M. Zorzi, "Polling Based Media Access Protocols for Use With Smart Adaptive Array Antennas", Conference Record, International Conference on Universal Personal Communications, Florence, Oct., 1998.
A. S. Acampora and S. V. Krishnamurthy, "A New Adaptive MAC Layer Protocol for Wireless ATM Networks in Harsh Fading and Interference Environments," IEEE Intl. Conf. Universal Personal Comm., San Diego, Oct. 1997.
A.S. Acampora and J.H. Winters, "A Wireless Network for Wide-Band Indoor Communications," JSAC, Vol. 5, No. 5, 1987.
A.S. Acampora and J.H. Winters, "System Applications for wireless Indoor Communications," IEEE Communications Magazine, Vol. 25, No. 8, 1987.
Yamaguchi et al., "4 GHz 8x8 Switch Matrix for SDMA System," Microwave Symposium, 1975 IEEE-MTT-S International.
Gerlach et al., "Spectrum Reuse Using Transmitting Antenna Arrays with Feedback," Acoustics, Speech, and Signal Processing, ICASSP, 1994.
S. Krishnamurthy, A. S. Acampora, and M. Zorzi, "Polling Based Media Access Protocols for Use With Smart Adaptive Array Antennas", Conference Record, International Conference on Universal Personal Communications, Florence, Oct., 1998.
A. S. Acampora and S. V. Krishnamurthy, "A New Adaptive MAC Layer Protocol for Wireless ATM Networks in Harsh Fading and Interference Environments," IEEE Intl. Conf. Universal Personal Comm., San Diego, Oct. 1997.
Gerlach et al., "Adaptive Transmitting Antenna Arrays with Feedback," IEEE Signal Processing Letters, Oct. 1994.
Gerlach et al., "Base Station Transmitting Antenna Arrays for Multipath Environments," Signal Processing, Oct. 1996.

Background Items
Foschini et al., "On Limits of Wireless Communications in a Fading Environment when Using Multiple Antennas," *Wireless Personal Communications*, 1998.
A. J. Paulraj and C. B. Papdias, "Space-Time Processing for Wireless Communications," IEEE Signal Processing Magazine, pp. 49-83, November 1997.
U.S. 7,529,305
S. Anderson et al., "An Adaptive Array for Mobile Communication Systems," IEEE Transactions on Vehicular Technology, Vol. 40, No. 1, February 1991.
G. Foschini et al., "BLAST Bell Labs Layered Space Time", Bell Labs.
L.H. Dean Chapman "First - Hand: Sidelobe Cancellers and the Like" http: ethw.org/First-Hand: Sidelobe_Cancellers_and_the_Like Apr. 122017 4 pagesburg and A.D. Wyner, "Capacity of the Gaussian Channel with Memory, The Multivariate Case", The Bell System Technical Journal, Vol. 53, Issue 5, May-June 1974.
D. Chapman, "First-Hand: Sidelobe Cancellers and the Like", IEEE,
A.J. Fenn, et al., "The Development of Phased-Array Radar Technology", Lincoln Laboratory Journal Vol. 12, Number 2.
G.J. Foschini, "Layered Space-Time Architecture for Wireless Communication in a Fading Environment when Using Multi-Element Antennas", Bell Labs Technical Journal.
A.R. Kaye, "Transmission of Multiplexed PAM Signals Over Multiple Channel and Diversity Systems", IEEE Transaction on Communications, Vol. 18, No. 5.
G. Raleigh, et al., "Characterization of Fast Fading Vector Channels for Multi-Antenna Communication Systems", IEEE.
G.G. Raleigh, et al., "Spatio-Temporal Coding for Wireless Communications", IEEE Transactions on Communications, Vol. 46, No. 3.
D.O. Reudink, et al., "A Scanning Spot-Beam Satellite System", The Bell System Technical Journal.
S.C. Swales, et al., "Multi-Beam Adaptive Base-Station Antennas for Cellular Land Mobile Radio Systems", IEEE.
W. Van Etten, "Maximum Likelihood Receiver for Multiple Channel Transmission Systems", IEEE Transactions on Communications.
J.H. Winters, "Optimum Combining in Digital Mobile Radio with Cochannel Interference", IEEE Journal on Selected Areas in Communications, Vol. SAC-2, No. 4.
U.S. 5,345,599, A.J. Paulraj, et al., "Increasing capacity in wireless broadcast systems using distributed transmission/directional reception (DTDR)", Sept. 6, 1994.
U.S. 5,515,378, R.H. Roy III and Bjorn Ottersen, "Spatial Division Multiple Access Wireless Communication Systems", May 7, 1996.
U.S. 5,642,353, R.H. Roy III, et al., "Spatial Division Multiple Access Wireless Communication Systems", June 24, 1997.
M. Cooper, "A Layman's Guide to Cellular", Annual Review of Communications.
R.H. Roy, "Application of Smart Antenna Technology in Wireless Communication Systems".
B. Ottersten, "Array Processing for Wireless Communications".
M. Cooper, et al., "Intelligent Antennas: Spatial Division Multiple Access", Intelligent Antennas: Spatial Division Multiple Access, 1996 Annual Review of Communications.
"Intellicell: A Fully Adaptive Approach to Smart Antennas" ArrayComm, Inc., 2002

Background Items
Commercial Deployment of Adaptive Antennas, Spectrum Management 2003, May 20-21, 2003
D. Nowicki, et al., "Smart Antenna Strategies", Mobile Communication International, April 1995.
M. Goldburg, et al., "The Impacts of SDMA on PCS System Design", IEEE.
J. Kang, et al., "Low Complexity Array Response Vector Estimation For Smart Antenna Systems", 2000 IEEE.
H. Li, et al., "Coded Beamforming for Block Fading Vector Channel", Dept. of Electrical and Computer Engineering, 2001, IEEE.
K.R. Dandekar, et al., "Effect of mutual coupling on direction finding in smart antenna applications", Electronics Letters, Oct. 26, 2000, Vol. 36, No. 22.
L. Bigler, et al., "Experimental Direction of Arrival and Spatial Signature Measurements at 900 MHz for Smart Antenna Systems", 1995 IEEE.
S-S. Jeng, et al., "Experimental Evaluation of Smart Antenna System Performance for Capacity Improvement", 1997 IEEE.
S-S. Jeng, et al., "Experimental Evaluation of Smart Antenna System Performance for Wireless Communications", IEEE Transactions on Antennas and Propagation, Vol., 46, No. 6, June 1998.
S-S Jeng, et al., "Experimental Studies of Spatial Signature Variation at 900 MHz for Smart Antenna Systems", 1998 IEEE.
K.R. Dandekar, et al., "Modeling And Prediction Of The Wireless Vector Channel Encountered By Smart Antenna Systems", Microwave And Optical Technology Letters, Vol. 35, No. 4, November 20, 2002.
S..C. Swales, et al., "Multi-Beam Adaptive Base-Station Antennas For Cellular Land Mobile Radio Systems", 1989 IEEE.
W. Yang, et al., "New Method for Designing Smart Antenna Downlink Weighting Vectors Based on the Filter Bank Concept", SPIE, Vol, 3162.
P. Balaban, et al., "Optimum diversity Combining and Equalization in Digital Data Transmission with Applications to Cellular Mobile Radio - Part I: Theoretical Considerations", 1992 IEEE.
J.A. Cadzow, et al., "Resolution Of Coherent Signals Using A Linear Array", 1987 IEEE.
G. Xu, et al., "Smart Antenna systems for Wireless Communications", 1988 IEEE.
J.H. Winters, et al., "The Impact of Antenna Diversity on the Capacity of Wireless Communication Systems", IEEE Transactions on Communications, Vol. 42, No. 2/3/4, February/March/April 1994.
H. Li, et al., "Transmission Optimization Over Flat Rayleigh Fading channel with Multiple Antennas", 1999 IEEE.
A. Kavak, et al., "Vector Channels for Smart Antennas - Measurements, Statistical Modeling, and Directional Properties in Outdoor Environments", IEEE Transactions On Microwave Theory And Techniques, Vol, 48, No. 6, June 2000.
A.F. Naguib, et al., "Performance Of CDMA Cellular Networks With Base-Station Antenna Arrays: The Downlink", 1994 IEEE.
U.S. 5,914,946, D. Avidor, et al., "TDM-Based Fixed Wireless Loop System", Jun. 22, 1999.
US 5,687,194 E. Paneth, et al., "Subscriber RF Telephone System For Providing Multiple Speech And/Or Data Signals Simultaneously Over Either A Single Or A Plurality Of RF Channels".

Background Items
U.S. 5,828,658, B.E. Ottersten, et al., "Spectrally Efficient High Capacity Wireless Communication Systems With Spatio-Temporal Processing", Oct. 27, 1998.
J. Liang & A. Paulraj, "Forward link antenna diversity using feedback for indoor communication systems", IEEE, 1995 International Conference on Acoustics, Speech, and Signal Processing, Vol. 3, pp. 1753-5
D. Gerlach & A. Paulraj, "Base station transmitter antenna arrays with mobile to base feedback", IEEE, Proceedings of 27th Asilomar Conference on Signals, Systems and Computers, Vol. 2, pp. 1432-6
A. Naguib, A. Paulraj, & T. Kailath, "Capacity improvement of base-station antenna arrays cellular CDMA", IEEE, Proceedings of 27th Asilomar Conference on Signals, Systems and Computers, Vol. 2, pp. 1437-41
G. Raleigh & V. K. Jones, "Adaptive Antenna Transmission for Frequency Duplex Digital Wireless Communication", IEEE, 1997 IEEE International Conference on Communications, Vol. 2, pp. 641-6
P. Lehne & M. Petterson, "An overview of smart antenna technology for mobile communications systems", IEEE Communications Surveys, Fourth Quarter 1999, Vol. 2, No. 4
A. Paulraj, "Smart antennas for battlefield multimedia wireless networks with dual use applications" (August 1998)
D. Gerlach, "Adaptive Transmitting antenna arrays at the Base Station in Mobile Radio Networks" (August 1995)
Yee, Limmartz, & Fettweis, "Multicarrier CDMA in indoor wireless radio networks", Proc. PMIRC '93, Yokohoma, Japan, pp. 109-113, September 1993
"Essentials of ATM Networks," Oliver C. Ibe, Addison-Wesley 1997
"Computer Networks", Andrew S. Tanenbaum, 3d Ed. Prentice Hall PTR 1996
T.E. Curtis, "Digital Beamforming for Sonar System," IEEE Proc. Pt. F, Vol. 127 pp. 257-265, Aug. 1980
P. Barton, "Digital Beamforming for radar", I EEE Proc. Pt. F., Vol. 266-267, Aug. 1980
S. Applebaum, "Adaptive Arrays," IEEE Trans. On Antennas and Propagation, Vo. AP-24, No. 5, pp. 585-598, Sep. 1976
R. T. Compton, Jr., *Adaptive Antennas: Concepts and Applications*, Prentice Hall, Englewood Cliffs, NJ, 1988
J.E. Hudson, *Adaptive Array Principles*, Peregrinus, London 1981
R. A. Monzingo & T.W. Miller, *Introduction to Adaptive Arrays*, John Wiley & Sons, 1980
W.F. Gabriel, "Adaptive Arrays – an introduction," Proc. IEEE, vol 64, pp. 239-272, Feb. 1976
B.D. Van Veen & K.M. Buckley, "Beamforming: A versatile approach to spatial filtering," IEEE ASSP Magazine, vol. 5, pp. 4-24, Apr. 1998
B. Widrow, P. E. Mantey, L. J. Griffiths, and B.B. Goode, "Adaptive Antenna Systems," Proc. IEEE, vol. 55, pp. 2143-2159, Dec. 1967
R. T. Compton, R. J. Huff, W.G. Swarner, and A. A. Ksienki, "Adaptive Arrays for Communication Systems: An overview of research at the Ohio State University", IEEE Trans. Antennas Propagation, vol. AP-24, pp. 599-607, 1976
B.G. Agee, S.V. Schell, and W. A. Gardner, "Spectral Self-Coherence Restoral: A New Approach to Blind Adaptive Signal Extraction Using Antenna Arrays," Proc. IEEE, vo. 78, pp. 753-767, Apr. 1990

Background Items
Q. Wu, K.M Wong, and R. Ho, "A fast algorithm for adaptive beamforming of cyclic signals," IEEE Proc. Pt. F, vo.. 141, pp. 312-318, Dec. 1994
J. H. Winters, "Increased Data Rate for Communication Systems with Adaptive Antennas," Proc. IEEE Int. Conf. Comm., June 1982
Y.S. Yeh and D. O. Reudink, "Efficient Spectrum Utilization for Mobile Radio Systems Using Space Diversity," IEEE Int. Conf. Radio Spectrum Conservation Techniques, London, pp. 12-16, 1980
Y. S. Yeh and D. O. Reudink, "Efficient Spectrum Utilization for Mobile Radio Systems Using Space Diversity," IEEE Trans. Comm. Vo. COM-30, pp. 447-455, March 1982
J. H. Winters, "Optimum combining in digital mobile radio with co-channel interference," *IEEE Trans. Veh. Technol.*, vol 33. Pp. 144-155, Aug. 1984
U.S. Patent No. 7,200,368
U.S. Patent No. 7,079,514
U.S. Patent No. 6,232,921
U.S. Patent No. 6,219,561
U.S. Patent No. 6,108,565
U.S. Patent No. 6,901,062
U.S. Patent No. 7,139,324
U.S. Patent No. 7,054,662
U.S. Patent No. 7,499,499
U.S. Patent No. 7,447,270
U.S. Patent No. 6,347,234
U.S. Patent No. 6,980,832
U.S. Patent No. 6,501,747
U.S. Patent No. 7,050,480
U.S. Patent No. 7,039,441
U.S. Patent No. 5,815,116
U.S. Patent No. 6,188,913
U.S. Patent No. 6,496,535
U.S. Patent No. 6,834,076
U.S. Patent No. 7,088,782
U.S. Patent No. 7,310,304
U.S. Patent No. 7,706,458
U.S. Patent Publication No. 2002/0086708
U.S. Patent Publication No. 2003/0017853
U.S. Patent No. 6,553,012
U.S. Patent No. 6,970,722
U.S. Patent No. 7,042,394
U.S. Patent Publication No. 2003/0060205
U.S. Patent No. 6,738,020
U.S. Patent No. 6,795,409
U.S. Patent No. 7,529,525

Background Items
L. Chen et al., "A Dynamic Channel Assignment Algorithm for Cellular System with Adaptive Array Antennas," IEEE Veh. Tech. Conf. 2001.
S. Perreau, "Combined Downlink Beamforming and Channel Estimation for High Data Rate CDMA Systems," Proc. IEEE Signal Processing Workshop on Statistical Signal Processing (2001)
F. Rashid Farrokhi et al, "Transmit Beamforming Power Control for Cellular Wireless Systems," 16 IEEE J. on Selected Areas in Commc'n 1437 (1998)
S. Choi et al., "Transmitter Power Control (TPC) and Dynamic Frequency Selection (DFS) Joint Proposal for 802.11h WLAN," IEEE 802.11-01/169r2
M. Ghosh et al, "On the Use of Multiple Antennae for 802.11," IEEE 802.11-02/180r0
H. Yu, "HDR 802.11a Solution Using MIMO-OFDM," IEEE 802.11-02/294r1
J. Regnier, "Benefits of Smart Antennas in 802.11 Networks," IEEE 802.11-03/025r0
A. van Zelst et al., "Space Division Multiplexing (SDM) for OFDM Systems," 51 IEEE Veh. Tech. Conf., Vol. 2, pp. 1070-1074 (Spring 2000)
A. Hori et al, "System Capacity and Cell Radius Comparison with Several High Data Rate WLANs" IEEE 802.11-02/159r1
P. Brenner, "A Technical Tutorial on the IEEE 802.11 Protocol," Breezcom Wireless Communications (July 18, 1996)
Siemens AG & Technical University of Munich, "Advanced closed loop Tx diversity concept (eigenbeamformer)," 3GPP TSGR1#14(00)0853, July 2000
H. Holma & A. Toskala, "WCDMA for UMTS," John Wiley & Sons, 2000
Donald Cox & Douglas Reudink, Dynamic Channel Assignment in High-Capacity Mobile Communications Systems, 50 Bell Sys. Tech. J. 1833 (1971)
Donald Cox & Douglas Reudink, A Comparison of Some Channel Assignment Strategies in Large-Scale Mobile Communications Systems, 20 IEEE Transactions Commc'ns 190 (1972)
Donald Cox & Douglas Reudink, Dynamic Channel Assignment in Two-Dimensional Large-Scale Mobile Radio Systems, 51 Bell Sys. Tech. J. 1611 (1972)
Donald Cox & Douglas Reudink, Increasing Channel Occupancy in Large-Scale Mobile Radio Systems: Dynamic Channel Reassignment, 21 IEEE Transactions Commc'ns 1302 (1973)
Harald Haas, Interference Analysis of and Dynamic Channel Assignment Algorithms in TD–CDMA/TDD Systems (2001)
Broadband Radio Access Networks (BRAN); HIPERLAN Type 2; Data Link Control (DLC) Layer; Part 1: Basic Data Transport Functions, ETSI TS 101 761-1 V1.2.1 (2000-11)
Broadband Radio Access Networks (BRAN); HIPERLAN Type 2; Data Link Control (DLC) Layer; Part 2: Radio Link Control (RLC) sublayer, ETSI TS 101 761-2 V1.2.1 (2001-04)
Broadband Radio Access Networks (BRAN); HIPERLAN Type 2; Physical (PHY) layer, ETSI TS 101 475 V1.2.2 (2001-02)
Broadband Radio Access Networks (BRAN); HIPERLAN Type 2; System Overview, ETSI TR 101 683 V1.1.1 (2000-02)
Harri Holma et al. Interference Considerations for the Time Division Duplex Mode of the UMTS Terrestrial Radio Access, 18 IEEE J. Selected Areas Commc'ns 1386 (2000)
IEEE P802.11 Wireless LANs Proposed DFS Test (Mar. 2002), IEEE 802.11-02/154r0
IEEE P802.11 Wireless LANs, IEEE802.11h, A Proposal for Dynamic Frequency Selection (DFS), IEEE 802.11-02/161r0 (Feb. 15, 2002)

Background Items
IEEE P802.11 Wireless LANs, TPC/DFS Proposal for 802.11h, IEEE 802.11-01/217 (Apr. 13, 2001)
Hua Jiang & Stephen S. Rappaport, CBWL for Sectorized Cellular Communications, CEAS Tech. Rep. No. 654 (1993)
Hua Jiang & Stephen S. Rappaport, A Channel Borrowing Scheme for TDMA Cellular Communication Systems, 1 IEEE 45th VTC 97 (1995)
Scott Jordan, Resource Allocation in Wireless Networks, 5 J. High Speed Networks 23 (1996)
Gordon J.R. Povey, Investigation of Multiple Access Interference Within UTRA-TDD, IEEE 10th European Signal Processing Conference (2000)
Miao Qingyu et al., An Investigation of Inter-Cell Interference in UTRA-TDD System, 6 IEEE VTS Fall VTC 3002 (2000)
Theodore S. Rappaport, Wireless Communications Principles and Practice (1st & 2d eds. 1996 & 2002)
Isabelle Tardy et al., Interference in TDD Based LMDS Systems, IST Mobile and Wireless Summit (2002)
Universal Mobile Telecommunications System (UMTS); UMTS Terrestrial Radio Access (UTRA); Concept Evaluation (UMTS 30.06 version 3.0.0), TR 101 146 v3.0.0 (1997-12)
Li-Chun Wang et al., Architecture Design, Frequency Planning, and Performance Analysis for a Microcell/Macrocell Overlaying System, 46 IEEE Transactions Vehicular Tech. 836 (1997)
U.S. 5,722,043
U.S. 6,985,465
U.S. 7,206,840
U.S. 6,859,450
U.S. 5,907,544
U.S. Patent Publication No. 2004/0037258
I. Katzela et al, "Channel Assignment Schemes for Cellular Mobile Telecommunications Systems: A Comprehensive Survey," IEEE Personal Communications 10 (1996)
IEEE 802.11-1999
IEEE 802.11a-1999
IEEE 802.11b-1999
IEEE 802.11f-2003
IEEE 802.11g-2003
S. Choi et al., "Transmitter Power Control (TPC) and Dynamic Frequency Selection (DFS) Joint Proposal for 802.11h WLAN," IEEE 802.11-01/169r2
M. Ghosh et al, "On the Use of Multiple Antennae for 802.11," IEEE 802.11-02/180r0
H. Yu, "HDR 802.11a Solution Using MIMO-OFDM," IEEE 802.11-02/294r1
J. Regnier, "Benefits of Smart Antennas in 802.11 Networks," IEEE 802.11-03/025r0
A. van Zelst et al., "Space Division Multiplexing (SDM) for OFDM Systems," 51 IEEE Veh. Tech. Conf., Vol. 2, pp. 1070-1074 (Spring 2000)
A. Hori et al, "System Capacity and Cell Radius Comparison with Several High Data Rate WLANs" IEEE 802.11-02/159r1
P. Brenner, "A Technical Tutorial on the IEEE 802.11 Protocol," Breezcom Wireless Communications (July 18, 1996)

Background Items
Siemens AG & Technical University of Munich, "Advanced closed loop Tx diversity concept (eigenbeamformer)," 3GPP TSGR1#14(00)0853, July 2000
H. Holma & A. Toskala, "WCDMA for UMTS," John Wiley & Sons, 2000
Litva, et al, "Digital Beamforming in Wireless Communications", Artech House Publishers, Publication date: August 31, 1996 ISBN 10: 0890067120 / ISBN 13: 9780890067123
Joseph C. Liberti et al, "Smart Antennas for Wireless Communications: Third Generation Cdma Applications," Publication date: January 1, 1999, ISBN-10: 0137192878, ISBN-13: 978-0137192878
Pieter van Rooyen et al., "Space-Time Processing for CDMA Mobile Communications," Publication date: February 29, 2000, ISBN-10: 9780792377597, ISBN:13: 978-0792377597
Da-Shan Shiu, "Wireless Communication Using Dual Antenna Arrays," Publication date: November 30, 1999, ISBN-10: 0792386809, ISBN-13: 978-0792386803
U.S. Patent No. 7,594,010
U.S. Patent No. 4,610,010
U.S. Patent No. 5,208,812
U.S. Patent No. 6,538,375
U.S. Patent Publication No. 2002/0120740
U.S. Patent No. 6,370,356
U.S. Patent No. 6,711,420
U.S. Patent No. 7,415,083
U.S. Patent No. 7,573,945
U.S. Patent No. 7,912,014
U.S. Patent Publication No. 2003/0138029
U.S. Patent No. 8,422,587
U.S. Patent Publication No. 2003/0188006
U.S. Patent Publication No. 2003/0198281
U.S. Patent Publication No. 2004/0157551
U.S. Patent Publication No. 2004/0185801
U.S. Patent No. 5,488,750
U.S. Patent No. 5,963,865
U.S. Patent No. 7,130,635
U.S. Patent No. 5,956,642
U.S. Patent No. 5,898,928
U.S. Patent No. 6,240,275
U.S. Patent No. 6,351,643
U.S. Patent No. 6,788,656
U.S. Patent No. 5,329,575
U.S. Patent No. 5,787,346
U.S. Patent No. 7,079,822
U.S. Patent No. 6,813,253
U.S. Patent No. 6,799,044
U.S. Patent No. 7,072,663
U.S. Patent No. 7,424,299

Background Items
U.S. Patent No. 6,456,844
U.S. Patent No. 7,408,907
U.S. Patent No. 5,850,596
U.S. Patent No. 7,206,840
U.S. Patent No. 7,483,711
Yang, "CDMA RF System Engineering", Publisher: Artech House Publishers, Publication date: April 30, 1998, ASIN: B0048D4TXK.
Litva, et al, "Digital Beamforming in Wireless Communications", Artech House Publishers, Publication date: August 31, 1996 ISBN 10: 0890067120 / ISBN 13: 9780890067123
Van Nee, et al, "OFDM for Wireless Multimedia Communications" Artech House Publishers, Publication date: December 31, 1999, ISBN-10 : 9780890065303, 0890065306.
Heiskala and Terry, "OFDM Wireless LANs: A Theoretical and Practical Guide", Publisher Sams, Publication date: 2001 (showing general state of the art); ISBN-10 : 0672321572; ISBN-13 : 978-0672321573
European Patent Application No. EP 0991202
U.S. Patent No. 6,377,631
U.S. Patent No. 6,711,123
U.S. Patent No. 6,834,043
U.S. Patent No. 7,054,375
U.S. Patent No. 7,110,378
U.S. Patent No. 6,144,711
U.S. Patent No. 5,513,215
U.S. Patent Publication No. 2002/0142782
Andrews, et. al., "Fundamentals of WiMAX". Publisher : Prentice Hall; 1st edition (February 27, 2007), ISBN-10 : 0132907801, ISBN-13 : 978-0132907804
Ghosh, et. al. "Fundamentals of LTE", (Prentice Hall Communications Engineering and Emerging Technologies Series) (2010)
Perahia, "Next Generation Wireless LANs". Cambridge University Press, 2008 (1st Edition)
PCT Application No. WO 2011/078898
Jose Vilches, "Everything You Need to Know about 4G Wireless Technology," (April 29, 2010), available at: https://www.techspot.com/guides/272-everything-about-4g/
Joy Huang, Commscope, "Re-shaping Wind Load Performance for Base Station Antennas," available at: https://www.commscope.com/globalassets/digizuite/762340-bsaenhanced-wind-load-performance-wp-115177-en.pdf
Philip Sorrells, "The Problems with Overweight Cell Towers," (September 2, 2014), available at: https://www.commscope.com/blog/2014/the-problems-with-overweightcell-towers/
Columbia Telecommunications Corp., "Cellular Tower Requirements Study for Talbot County, Maryland" (April 2009), available at: https://talbotcountymd.gov/uploads/File/council/Cellular_Study_FINAL.pdf
U.S. Patent Publication No. 2003/0032424
U.S. Patent Publication 2008/0026796
PCT Application No. WO 92/12579

Background Items
U.S. Patent No. 3,255,450
U.S. Patent No. 6,006,077
U.S. Patent No. 6,879,823
U.S. Patent No. 6,662,024
U.S. Patent No. 6,208,863
U.S. Patent Application Publication No. 20020080862
U.S. Patent No. 7,340,017
U.S. Patent No. 6,792,031
Andrea Goldsmith, Wireless Communications, Cambridge University Press, 2005
U.S. Patent No. 6,661,832
U.S. Patent No. 6,594,318
U.S. Patent No. 3,663,762
Antennas, Second Edition by John D. Kraus, McGraw-Hill (1988)
"Adaptive Multicarrier Modulation: A Convenient Framework for Time-Frequency Processing in Wireless Communications" by T. Keller et al. was published in the IEEE Proceedings of the IEEE at pp. 611-640 of Vol. 88, No. 5, May 2000
"Advanced closed loop Tx diversity concept (eigenbeamformer)", 3GPP TSGR1#14(00)0853, by authors from Siemens AG and Technical University of Munich
Authoritative Dict. of IEEE Standard Terms
"Electrical oscillations and wireless telegraphy" by Karl Ferdinand Braun *Nobel Lecture, December 11, 1909*
U.S. Patent No. 8,488,445
EIA Interim Standard, Recomminded Minimum Standards for 800 MHZ Cellular Subscriber Units
"Binary Data Transmission Techniques for Linear Systems," by M.L. Doelz, et. al., Proceedings of The IRE (Original manuscript received by the IRE, September 4, 1956; revised manuscript received February 1, 1957.)
Kineplex Data Transmission, Chapter 12
Kineplex High Speed Data Transmission System, available at: https://collinsaerospacemuseum.org/collins_brochures/pdf/KineplexBrochure.pdf
U.S. Patent No. 2,292,387
MIM-104 Patriot (Wikipedia Entry) available at https://en.wikipedia.org/wiki/MIM-104_Patriot
Mobile Telephony – Wide Area Coverage – Case 20564, Technical Memoranda, Bell Telephone Laboratories ("Ring")
U.S. Patent No. 5,642,353
Channels, Propagation and Antennas for Mobile Communications (Electromagnetic Waves) by Rodney Vaughan and Jørgen Bach Andersen
Data Transmission by Frequency-Division Multiplexing Using the Discrete Fourier Transform by S.B. Weinstein, Ieee Transactions On Communication Technology, Vol. COM-19, No. 5, October 1971
Installation and Operation Manual for RF-3466A, Harris RF Communications Publication No. 10133-3020, October 1988

Background Items
Maintenance Manual for RF-5020 R/T, Harris RF Communications Publication No. 10181-0033, October 1991
History of Wireless Local Area Networks (WLANs) in the Unlicensed Bands by Kevin Negus and Al Petrick, George Mason University Law School Conference, Information Economy Project, Arlington, VA., April 4, 2008
TD -3 Microwave Radio Relay System by S.D. Hathaway, et al., The Bell System Technical Journal, Vol. 47, No. 7, September 1968
U.S. Patent No. 725,605
WaveLAN High-Speed Multimode Chip, Agere Systems Datasheet, February 2003
WaveLAN 802.11b Chip Set for Standard Form Factors, Agere Systems Preliminary Product Brief, December 2002
WL1141, Single-Component 802.11b Physical Layer Solution, Agere Systems, Product Brief, November 2002
WaveLAN WL60040, Multimode Wireless LAN Media Access Controller (MAC) Agere Systems, Product Brief, August 2003
DynaTAC 8000 Product
Netgear WGR614 wireless router Product
Proxim Harmony 802.11a PC Card Product
Vivato 2.4 GHz Wi-Fi Switch Product
U.S. Patent No. 7,062,296
Anastasi et. al. "MAC Protocols for Wideband Wireless Local Access: Evolution Towards Wireless ATM" IEEE Personal Communications Magazine pp. 53-64 Oct. 1998 Berg J. "Building penetration loss along urban street microcells" in Proceedings of PIMRC '96 —7th International Symposium on Personal Indoor and Mobile Communications 3: 795-797 (1996)
Damoss E. and L. Correia eds. COST 231 Final Report Digital Mobile Radio — Towards Future Generation Systems. European Commission Directorate General XIII Report No. RJR 18957 (ISBN 92-828-54167) 516 pages. (1999)
Deng S. "Empirical Model of WWW Document Arrivals at Access Link" Communications 1996. ICC '96 Conference Record Converging Technologies for Tomorrow's Applications. 1996 IEEE International Conference 197-202 (1996)
Gans et al. "High data rate indoor wireless communications using antenna arrays" in Proceedings of 6th International Symposium on Personal Indoor and Mobile Radio Communications 3: 1040-1046 (1995)
German et al. "Wireless Indoor Channel Modeling: Statistical Agreement of Ray Tracing Simulations and Channel Sounding Measurements" in Proceeding of 2001 IEEE International Conference on Acoustics Speech and Signal Processing 4: 2501-2504 (2001)
Gucsalla R. "Characterizing the Variability of Arrival Processes with Indexes of Dispersion" IEEE JSAC 9 (2): 203-211 (1990)
Hashemi H. "The Indoor Propagation Channel" Proceedings of the IEEE 81 (7): 943-968 (1993)
Jakes W.C. ed. Microwave Mobile Communications. Wiley 1974
Kivinen et al. "Empirical Characterization of Wide hand Indoor radio Channel at 5.3 GHz" IEEE Transactions on Antennas and ProtJagation 49 (8): 1192-1203 (2001)
Leland et. Al. "On the Self - Similar Nature of Ethernet Traffic" IEEE / ACM Transactions on Networking 2 (1): 1-15 (1994)

Background Items
Medbo J. and J. Berg "Simple and accurate path loss modeling at 5 GHz in indoor environments with corridors" in Vehicular Tech nology Conference Fall 2000. IEEE VTS Fall VTC2000. 52nd Vehicular Technology Conference 1: 30-36 (2000)
Martin Cooper "A Layman's Guide to Cellular Annual Review of Communications" 1996
Anderson et al. "An Adaptive Array for Mobile Communication Systems" IEEE Transactions on Vehicular Technology vol. 40 No. 1 Feb. 1991 pp. 230-236
Dean Chapman "First - Hand: Sidelobe Cancellers and the Like" http: ethw.org/First-Hand: Sidelobe_Cancellers_and_the_Like Apr. 12, 2017
Li Hang et al. "Coded Beamforming for Block Fading Vector Channel" 2001 IEEE pp. 1137-1141
Xu G. et al. "Experimental Studies of Space - Division – Multiple Access Schemes for Spectral Efficient Wireless Communications" 1994 IEEE pp. 800-804
Li Hang et al. "Transmission Optimization Over Flat Rayleigh Fading Channel with Multiple Antennas" 1999 IEEE pp. 210-214
Related Virtual Exhibits Smart Antenna Systems Tutorial IEC ComForum at WCA 2001: Jun. 25-27 2001 World Trade Center Boston MA USA
Interface Feb. 1999 pp. 176-181 ; Interface Mar. 1999 pp. 168 173
Wolniansky P. W. et al. "V - Blast: An Architecture for Realizing Very High Data Rates Over the Rich - Scattering Wireless Channel" Proc. URSI ISSSE: 295-300 Sep. 1998
Acampora A.S. et al. "Media Access Protocols for Use with Smart Adaptive Array Antennas to Enable Wireless Multimedia Applications" 9th Tyrrehenian Workshop on Digital Communications Lerici (Italy) Sep. 1997.
I.A. Glover and P.M. Grant, Digital Communications, Prentice Hall Europe 1998
Hillebrand ed. "GSM and UMTS: The Creation of Global Mobile Communication" John Wiley & Sons Ltd. 2002
Andrew T. Campbell et al. "Design Implementation and Evaluation of Cellular IP" IEEE Personal Communications (Aug. 2000)
Donghee Shim et al. "Should the Smart Antenna Be a Tracking Beam Array or Switching Beam Array?," 48th IEEE Vehicular Technology Conference (VTC'98) (May 21 1998)
Sandra Kay Miller "Facing the Challenge of Wireless Security" Computer pp. 16-18 (Jul. 2001)
Jack H. Winters "Smart Antennas" Chapter 6 of WTEC Panel Report on Wireless Technologies and Information Networks (Jul. 2000)
Constantine Balanis, Antenna Theory (1997)
S.C. Swales et al. "The Performance Enhancement of Multibeam Adaptive Base – Station Antennas for Cellular Land Mobile Radio Systems" IEEE Transactions on Vehicular Technology vol. 39 No. 1 (Feb. 1990)
Joseph C. Liberti Jr. et al. Smart Antennas for Wireless Communications (1999) (selected pages)
IEEE Standards Bearer (Oct. 1997)
Bellafiore et al. "Smart antenna system analysis integration and performance for mobile ad – hoc networks (MANETs) in IEEE Transactions on Antennas and Propagation vol. 50 No. 5 pp. 571-581 May 2002 (Year: 2002)

Background Items
Lal et al. "A novel MAC layer protocol for space division multiple access in wireless ad hoc networks" Proceedings. Eleventh International Conference on Computer Communications and Networks Miami FL USA 2002 pp. 614-619 (Year: 2002)

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CERTIFICATE OF SERVICE

The undersigned hereby certifies that counsel of record who are deemed to have consented to electronic services are being served with a copy of this document via the Court's CM/ECF system per Local Rule CV-5(a)(3) on August 11, 2025.

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